

Quality Performance Improvement With the Implementation of Standard Chemotherapy Order Forms

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Abstract

Purpose: Before October 2000, physicians in our institution handwrote chemotherapy orders on blank order sheets. There was no standard to which the physician could include variables that were crucial to the completeness of a chemotherapy order. For this reason, chemotherapy orders were frequently incomplete and had to be adjusted by the pharmacist after discussing the missing variables with the ordering physician. As a part of our goal to minimize errors, standard chemotherapy forms were initiated at our institution in October 2000.

Methods: The first standard form implemented was a written order form that constituted a standard of the ideal variables necessary to accurately complete chemotherapy orders. These variables were the diagnosis, regimen, height, weight, body surface area (BSA), route, frequency, duration and chemotherapy dose and calculation based upon BSA. The next updated form was an

electronic version similar to the original, and was implemented in April 2002.

Results: From February 1999 to March 2000, using the traditional unstandardized blank order sheets, the average order completeness was 45%. After the standard written forms were introduced, from October 2000 to March 2002, the average chemotherapy order completeness was 81%, an improvement of 36%. Completeness improved to an average of 93% from April 2002 to December 2003, after the implementation of the electronic chemotherapy form.

Conclusion: Chemotherapy order completeness improves considerably through the standardization of chemotherapy order forms. The electronic forms show an additional improvement over handwritten forms. Electronic standardization of chemotherapy forms should be adopted as a best-practice model in hematology-oncology practices throughout the country.

Introduction

A systems approach recognizes that all humans are fallible and will err, and then develops mechanisms in which errors are less likely to occur and are identified when they do occur.¹ To optimize the quality of care provided in medicine, it is crucial to implement a system that reduces the number of chemotherapy errors that reach the patient.² Although rare, errors with the administration of antineoplastic medication can be fatal. Oncologists have no greater or lesser chance of erring than other physicians, but the high toxicity and small therapeutic index of the medications they prescribe make chemotherapy errors potentially catastrophic.² The goal of minimizing these errors is an evolving process in the practice of oncology.

Providence Hospital and Medical Centers (Southfield, Michigan) is a 459-bed, tertiary-care, community-teaching hospital. A floor pharmacy and one clinical pharmacist serve the need of the 31-bed adult oncology ward. Before the implementation of standardized forms in October 2000, chemotherapy orders were handwritten by the oncology attendings and oncology fellows on blank medication order sheets. An unending predicament at our pharmacy was receipt of handwritten chemotherapy orders that were unclear or incomplete. For example, these orders often lacked crucial information to its completeness, such as regimen dose, number of doses, and route of administration. In addition, abbreviations and the use of trailing zeros were a frequent problem with the orders. Incomplete chemotherapy orders had to be adjusted by the pharmacist after contacting the physician, adding an unnecessary amount of time executing the chemotherapy order. Lack of a standard format to

chemotherapy orders also potentially increased the risk for a serious medication error.³

The oncology division has a multidisciplinary quality performance improvement (QPI) committee with a focus on reducing chemotherapy errors. Quality issues are addressed by the QPI committee, which comprises the medical director of oncology, oncology attendings, oncology nurses and Fellows, a pharmacist, a social worker, and a clinical nurse specialist. Every meeting focuses on topics such as the progress in our oncology division and opportunities for improvement. The frequency of incomplete and unclear chemotherapy orders was discussed at several meetings.

Data from the literature have demonstrated that standardized chemotherapy forms have improved physician prescribing patterns, prescription completeness, and have reduced the potential for medication errors.³ The purpose of this study was to determine whether standardization of chemotherapy orders would lead to improvement in the physicians' inclusion of necessary chemotherapy order variables. Therefore, handwritten standardized chemotherapy order forms were implemented in October 2000 as part of a systems approach. In February 2002, our aim was to determine whether an electronic standardized form would be superior to the written standardized form in terms of completeness and reduction of pharmaceutical clarifications.

Methods

As mentioned, before the initiation of our project, chemotherapy orders were handwritten by the physicians on blank order

sheets. There was no standard to which the physician could accurately complete a chemotherapy form that included all of the necessary variables involved in the formulation of a complete chemotherapy order. According to pharmaceutical literature, variables deemed necessary for chemotherapy completeness are the diagnosis, regimen, height, weight, body surface area (BSA), route, frequency, duration, and chemotherapy dose and calculation based upon BSA.⁴ Inclusion of these variables significantly reduces the need for the pharmacist to contact the physician for chemotherapy clarifications before executing the order. In addition, inclusion of these variables decreases the rate of other pharmaceutical clarifications, and potentially diminishes the chance for a medication error.⁴

Standard chemotherapy forms were initiated at our institution in October 2000 (Fig 1). This standard form was created by the Pharmacy Department in conjunction with the prescribing physicians and the computer physician order entry design team. This form was then approved by the Hematology-Oncology Section, the Pharmacy and Therapeutics Committee, the Medical Executive Committee, and the Providence Hospital Forms Committee. These initial standard chemotherapy forms prompted the prescriber to include all the variables necessary in chemotherapy order completeness. In addition, antiemetics, hydration, and premedications were included in the format of the order. Use of this form was made mandatory by the Pharmacy Department. Pharmacists, nurses and physicians underwent in-service training about the written standardized form.

After implementation, data were collected on a monthly basis to assess the percentage of chemotherapy orders that contained all of the variables (diagnosis, regimen, height, weight, BSA, etc.) necessary in chemotherapy order completeness. Specifically, the data collected was whether a chemotherapy order did or did not contain all of these variables, and the number of other chemotherapy order clarifications independent of the above-mentioned variables. "Percentage of completeness" was defined as the number of orders that contained all of these necessary chemotherapy variables divided by the total number of submitted orders. A "percentage of chemotherapy order clarifications" was also calculated, which was defined as the number of orders with an adjustment to a regimen divided by the total number of chemotherapy orders after the pharmacist contacted the pre-

Figure 1. Standardized handwritten chemotherapy form.

ST JOHN PROVIDENCE
HEALTH

Physician Order Sheet
STANDARDIZED CHEMOTHERAPY ORDER FORM

ALLERGIES/REACTIONS: _____

PREMEDICATIONS
PREHYDRATION
☐ D5%W/.45%NS 1000ml + 20mEq KCl; rate: _____ ml/hour x _____ liters, prior to chemotherapy
Other: _____

ANTIEMETICS – 30-60 minutes prior to chemotherapy

<input type="checkbox"/> Dolasetron 100mg IV Push	<input type="checkbox"/> Dolasetron 100mg PO	Schedule
<input type="checkbox"/> Granisetron 2mg PO every 24 hours	<input type="checkbox"/> Granisetron 1mg PO every 12 hours	Days _____
<input type="checkbox"/> Dexamethasone 10 mg or 20mg	Circle Route: PO IV PUSH	Days _____
<input type="checkbox"/> Lorazepam _____mg	Circle Route: PO IV PUSH SL	Days _____

OTHER
☐ Paclitaxel Premeds: Dexamethasone 20mg IV Push; Diphenhydramine 50 mg IV Push; Famotidine 20mg IVPB
☐ Mannitol 12.5gm IV Push x 1 prior to Cisplatin
Other: _____

CHEMOTHERAPY ORDERS

Diagnosis= _____	Wt= _____	Ht= _____	BSA= _____
Regimen: _____	Day 1 (date) = _____	Frequency	

1. _____ mg/m² = _____ mg x _____ % = _____ mg _____ Days _____
AUC = _____
Circle route: IV Push IVPB IV Cont. Infusion IT PO Other: _____
Additional Instructions: _____

2. _____ mg/m² = _____ mg x _____ % = _____ mg _____ Days _____
Circle route: IV Push IVPB IV Cont. Infusion IT PO Other: _____
Additional Instructions: _____

3. _____ mg/m² = _____ mg x _____ % = _____ mg _____ Days _____
Circle route: IV Push IVPB IV Cont. Infusion IT PO Other: _____
Additional Instructions: _____

4. _____ mg/m² = _____ mg x _____ % = _____ mg _____ Days _____
Circle route: IV Push IVPB IV Cont. Infusion IT PO Other: _____
Additional Instructions: _____

POST-CHEMOTHERAPY MEDICATIONS
☐ Prochlorperazine 10mg IV Push every 6 hours prn nausea; OR _____
☐ Lorazepam _____mg IV Push every 8 hours prn nausea
☐ D5%W/.45%NS 1000ml + 20mEq KCl + 1gm MgSO₄ + 25gm Mannitol; rate: _____ ml/hour x 1 liter
Other: _____

(Use additional order sheet for further details.)

Time Noted: _____	Transcriber: _____	Physician Signature: _____	Pager # _____	Date: _____	Time: _____
AM/PM _____					

084560573 9/00 White: Chad Yellow: Pharmacy

scribing physician. This was independent of the percentage of completeness.

Then, an electronic form of the original was implemented in February 2002 (Fig 2). Those variables required for completeness were electronically made mandatory for order submission. The physician was electronically directed to provide a complete order. Therefore, if a physician did not include a certain component of the order, he could not submit the form to the pharmacy.

The electronic forms avoided ambiguity about medication names because standard chemotherapy medications were included in the electronic program. In addition, the ordering program calculated the BSA after the prescriber correctly in-

Figure 2. Standardized electronic chemotherapy form.

PROVIDENCE
HOSPITAL AND MEDICAL CENTER

STANDARDIZED CHEMOTHERAPY ORDER FORM

PREMEDICATIONS

Select Hydration: _____ Rate: None ml/hour x 1 liter

Other: _____

ANTIEMETICS (30-60 minutes prior to chemotherapy)

Drug	Dose	Route	Frequency	Schedule (Days)
<input type="checkbox"/> Dolasetron Inj.	100 mg	IV Push	Daily	<u>None</u>
<input type="checkbox"/> Dolasetron tablet	100 mg	Oral	Daily	<u>None</u>
<input type="checkbox"/> Granisetron tablet	2 mg	Oral	Daily	<u>None</u>
<input type="checkbox"/> Granisetron tablet	1 mg	Oral	every 12 hours	<u>None</u>
<input type="checkbox"/> Dexamethasone Inj.	10mg	IV Push	Daily	<u>None</u>
<input type="checkbox"/> Dexamethasone tablet	10mg	Oral	Daily	<u>None</u>
<input type="checkbox"/> Lorazepam tablet	0.5mg	Oral	Daily	<u>None</u>
<input type="checkbox"/> Lorazepam Inj.	0.5mg	IV Push	Daily	<u>None</u>

Other: _____

OTHER

☐ Paxilaxel Premeds Dexamethasone 20mg IV Push, Diphenhydramine 50mg IV Push, Famotidine 20mg IVPB

☐ Mannitol 12.5gm IV Push x 1 prior to Cisplatin

Other: _____

CHEMOTHERAPY ORDERS

☐ Male ☐ Female Age: _____ Weight: _____ Lbs Height: _____ in BSA: 0.00 m2 Rounded to = _____ m2

Diagnosis: Select Diagnosis Serum Creatinine: _____

Regimen: _____ Start Day 1 (date): _____

1. Select Drug: _____ = _____ x 100 %; Dose = _____

Route: _____ Freq: _____ Sched. (Days): _____ Rounded to = _____

Additional Instructions: _____

2. Select Drug: _____ = _____ x 100 %; Dose = _____

Route: _____ Freq: _____ Sched. (Days): _____ Rounded to = _____

Additional Instructions: _____

3. Select Drug: _____ = _____ x 100 %; Dose = _____

Route: _____ Freq: _____ Sched. (Days): _____ Rounded to = _____

Additional Instructions: _____

4. Select Drug: _____ = _____ x 100 %; Dose = _____

Route: _____ Freq: _____ Sched. (Days): _____ Rounded to = _____

Additional Instructions: _____

(Go to the next page for additional chemotherapy orders)

POST-CHEMOTHERAPY MEDICATIONS:

Drug	Dose	Route	Frequency
<input type="checkbox"/> Prochlorperazine Inj.	10mg	IV Push	Every 6 hours as need for nausea
<input type="checkbox"/> Prochlorperazine tablet	10mg	Oral	Every 6 hours as need for nausea
<input type="checkbox"/> Lorazepam Inj.	0.5mg	IV Push	Every 6 hours as need for nausea
<input type="checkbox"/> Lorazepam tablet	0.5mg	Oral or Sublingual	Every 6 hours as need for nausea
<input type="checkbox"/> Promethazine Inj.	12.5mg	IV Push	Every 6 hours as need for nausea
<input type="checkbox"/> Metoclopramide Inj.	10mg	IV Push	Every 6 hours as need for nausea
<input type="checkbox"/> Metoclopramide tablet	10mg	Oral	QID as needed for nausea
<input type="checkbox"/> D5%W, 45%NS 1000ml + 20mEq KCl + 1gm MgSO4 + 25 gm Mannitol			Rate: <u>None</u> ml/hour x 1 liter

Other: _____

Date/Time: _____ Ordered By: _____ Pager: _____ Transcribed By: _____ Date/Time: _____

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Submit Order

sorted the height and weight, eliminating the potential for a manual miscalculation. Antiemetics and types of hydration were also formatted into the electronic orders.

Results

Our chemotherapy order database dates back to February 1999. At that time, nonstandardized blank order sheets were the only method for the physician to order chemotherapy. Data were collected for the total number of chemotherapy orders that were written by the pharmacy and reviewed monthly. All of the attendings and Fellows in the Hematology-Oncology Division who had the privilege of writing chemotherapy orders were assessed. There were seven to eight attending physicians and six Fellows writing chemotherapy orders in each time period studied. Data were analyzed by comparing a trend among time periods.

From February 1999 to March 2000, a total of 473 chemotherapy orders were written with the traditional, nonstandardized

blank order sheets. The mean completeness on a monthly basis was approximately 45%. In October 2000, mandatory standard written forms were introduced by the Pharmacy Department. From October 2000 to March 2002, a total of 546 orders were analyzed. The average monthly chemotherapy order completeness rose to a mean of 81%, an improvement of 36%. The total percentage of chemotherapy order clarifications was 5.6%.

In April 2002, a standard electronic chemotherapy order form was implemented. From April 2002 to December 2003, of 570 chemotherapy orders, the average order completeness rose to a mean of 93%. For 4 consecutive months, the orders were 100% complete (Fig 3). With the electronic forms, the total percentage of chemotherapy order clarifications decreased to 4.5% (Fig 4).

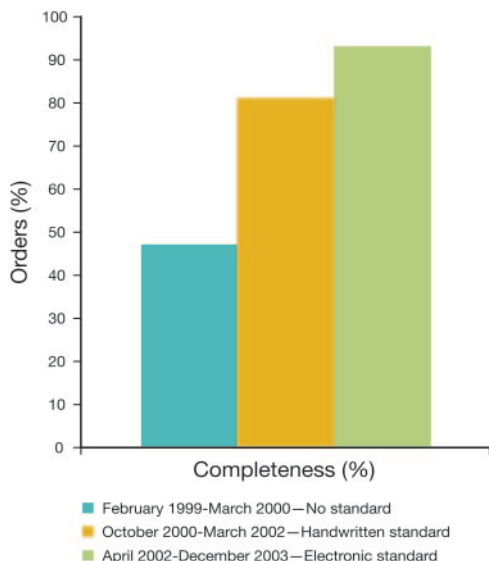
In some instances, the pharmaceutical clarifications also changed certain aspects of the chemotherapy order. For example, if the BSA was miscalculated on the handwritten orders, the clarified BSA would alter the dose of the chemotherapy utilized. However, with the electronic orders, a BSA was automatically calculated after the physician inserted the correct height and weight, minimizing a need for a change in the dose of the chemotherapy order.

Discussion

Pharmacists and nurses found that the electronically submitted orders were more complete and clearer to understand than the handwritten orders, also reducing the

clarification rate. The pharmacists reported that there was a reduction of time spent clarifying orders, although the actual time spent by pharmacists clarifying and processing the orders were not recorded. Abbreviations and trailing zeros were not an issue with the electronic format because the standard chemotherapy medications were formatted into the program and the computer program electronically calculated the total dose.

In addition, the physicians prescribing the electronic chemotherapy orders believed that there was an additional advantage to the electronic orders compared with the handwritten order. The electronic orders were permanently included in the hospital electronic medical record. When the patient was readmitted for a subsequent chemotherapy course, the physician could quickly review the prior treatment regimen in terms of chemotherapy, antiemetics, and hydration used. Additionally, because the BSA was calculated for the physician after insertion of the patient's height and weight and the desired chemotherapy dosage, the

Figure 3. Total percentage of chemotherapy order completeness.

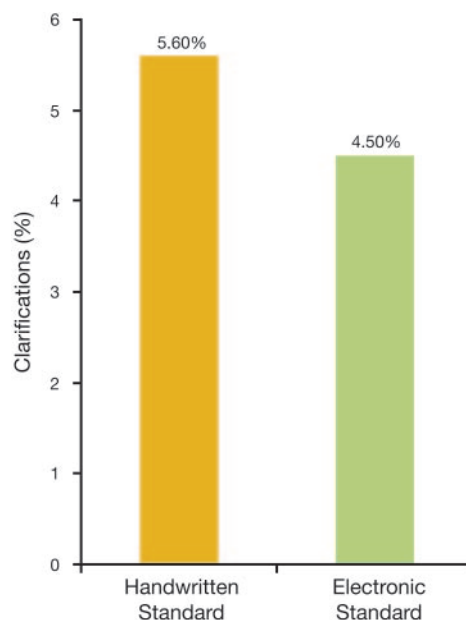
computer program electronically calculated the total dose to be administered.

Thorn et al⁵ reported that the use of a cancer chemotherapy prescription form in their institution resulted in improved compliance with prescribing guidelines and encouraged the writing of complete orders. Our QPI project demonstrates that chemotherapy order completeness, through the inclusion of necessary chemotherapy variables, improves considerably with the standardization of chemotherapy order forms. The implementation of a cancer chemotherapy order form also significantly reduces the time spent by the pharmacist on clarifying orders.

The electronic forms also show an additional improvement over handwritten standard forms in terms of completeness, reduction of chemotherapy order clarifications, and electronic calculation of BSA and chemotherapy doses. Among its many benefits, electronic communication of medication orders allows for more accurate conveyance of information than handwritten formats to all parties involved.⁶ The age of modern technology has raised the bar on improving the quality of medicine in many different ways. Safety experts currently recommend using technology to prevent medication errors.⁷ As technology matures, it is imperative that the practice of medicine seizes it for its own progress. Computerized prescription order entry is a way that technology is being allocated to promote safety.⁷

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Figure 4. Total percentage of chemotherapy order clarifications.

A future aim of the QPI committee is to improve the electronic form by automatically having the ability to populate required fields with the specifics of a standard regimen. For example, if the prescriber clicks "CHOP-R," the computer will automatically have the ability to insert the correct medications, standard doses, route of administration, etc., in the appropriate fields of the electronic chemotherapy order.

The standardized chemotherapy forms were a success at our institution. Through the implementation of the forms, the goal of the QPI committee was accomplished. There was evidence that these standard forms led to a higher percentage of completeness, therefore minimizing the chance of a medication error. By means of achieving additional improvements, electronic standardization of ordering chemotherapy should be adopted as a standard of care throughout the country.

Authors' Disclosures of Potential Conflicts of Interest

The authors indicated no potential conflicts of interest.

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